e2v

DIVIINA® LM1
Line Scan Camera

DIVIINA LM1 Camera
User Manual

Summary

1 CAMERA OVERVIEW

1.1 Features

- *Sensor: 1024 to 4096 pixels, 10 or 14 µm square*
- *Data Rate : 40MPixels on two channels*
- *Line Rate Up to 35,5 KHz*
- *Bit Depth : 8 bits*
- *Gigabit Interface (Base)*
- *Dimensions: 60 x 60 x 65 (w, h, l)*
- *Anti-blooming*
- *Cost effective and easy to use.*
- *Fully configurable with GEVPlayer software.*

1.2 Key Specifications

Feature/Specification		Value		Unit
Camera Characteristics				
Resolution	1024	2048	4096	Pixels
pixel size (square)	10 or 14	10 or 14	10	µm
Max line rate	35.7	18.1	9.5	kHz
Bit depth		8		Bits
Radiometric Performance at Maximum Pixel Rate and minimum camera gain				
	Typical		**Max**	
Peak Response (14µm pixel size)	12.5		-	LSB/(nJ/cm²) 8bits
Peak Response (10µm pixel size)	5.8		-	LSB/(nJ/cm²) 8bits
Response non linearity	1		2	%
PRNU	5		10	%
Dynamic range	58		-	dB 8bits
Functionality (Programmable via Control Interface)				
Gain	Up to 30,8 dB			
Offset	Up to 255 LSB			

Mechanical and Electrical Interface		
Size (w x h x l)	60 x 60 x 42	mm
Weight	210 g (without mount)	g
Lens Mount	M42 x 1 (by default) F (Nikon) or C optional mounts	

Sensor alignment	±200	µm
Sensor flatness	±30	µm
Power supply	Single 12 to 24	V
Power dissipation	7 (max)	W
General Features		
Operating temperature	0 to 65 (front face)	°C
Storage temperature	-40 to 70	°C
Regulatory	CE and RoHS compliant, GigEVision 1.1 GenICam 1.0 SFNC 1.3	

1.3 Description

DiViiNA LM1 is a cost efficient CCD line scan camera family with GigE Vision interface. Featuring e2v's own high performance linear CCD sensors from 1024 pixels up to 4096 pixels, as used in the world recognized AViiVA cameras; DiViiNA LM1 cameras offer high image quality with user-friendly simplicity. DiViiNA LM1 is the perfect candidate for mid range machine vision applications.

1.4 Typical Applications

- Web Inspection (Wood, Paper, Metallurgy)
- Part inspection and sorting (Cotton, Rice, Food)
- General Machine Vision Inspection

1.5 Models & Part numbers

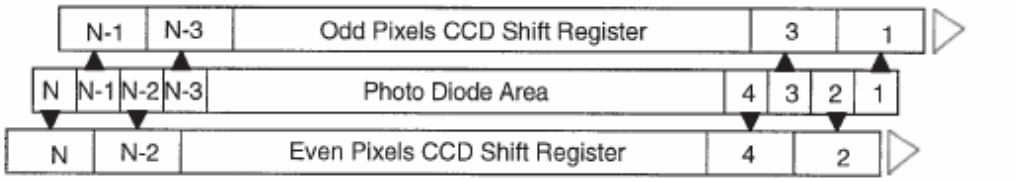
Table 5-1. Ordering Code

Part Number	Sensor type (Resolution, Pixels size)	Description
Camera		
EV50YLM1GE1010-BA0	1024 pixels, 10µm size	DIViiNA LM1 GE 1010
EV50YLM1GE2010-BA0	2048 pixels, 10µm size	DIViiNA LM1 GE 2010
EV50YLM1GE4010-BA0	4096 pixels, 10µm size	DIViiNA LM1 GE 4010
EV50YLM1GE1014-BA0	1024 pixels, 14µm size	DIViiNA LM1 GE 1014
EV50YLM1GE2014-BA0	2048 pixels, 14µm size	DIViiNA LM1 GE 2014
Accessories		
EV50-MOUNT-F		F-Mount (Nikon)
EV50-MOUNT-C		C-Mount

2 IMAGE SENSOR

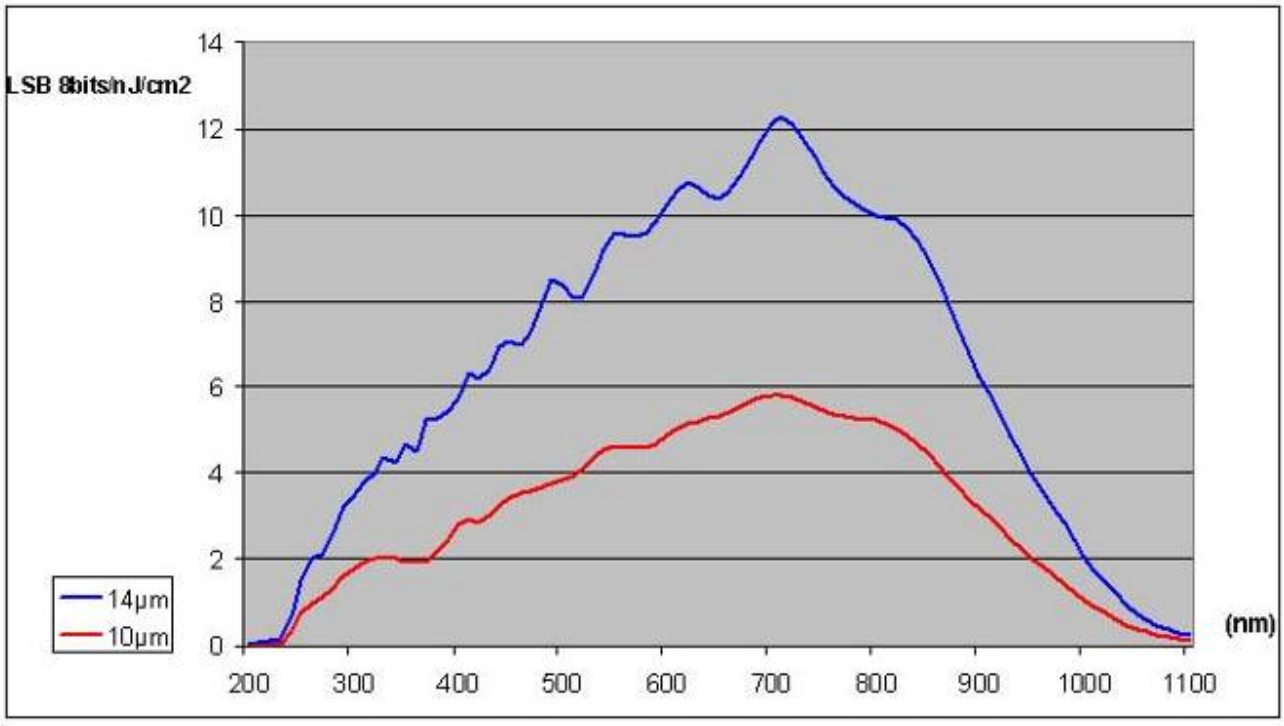
2.1 Sensor Structure

The sensor has a odd/even structure in two taps as following :



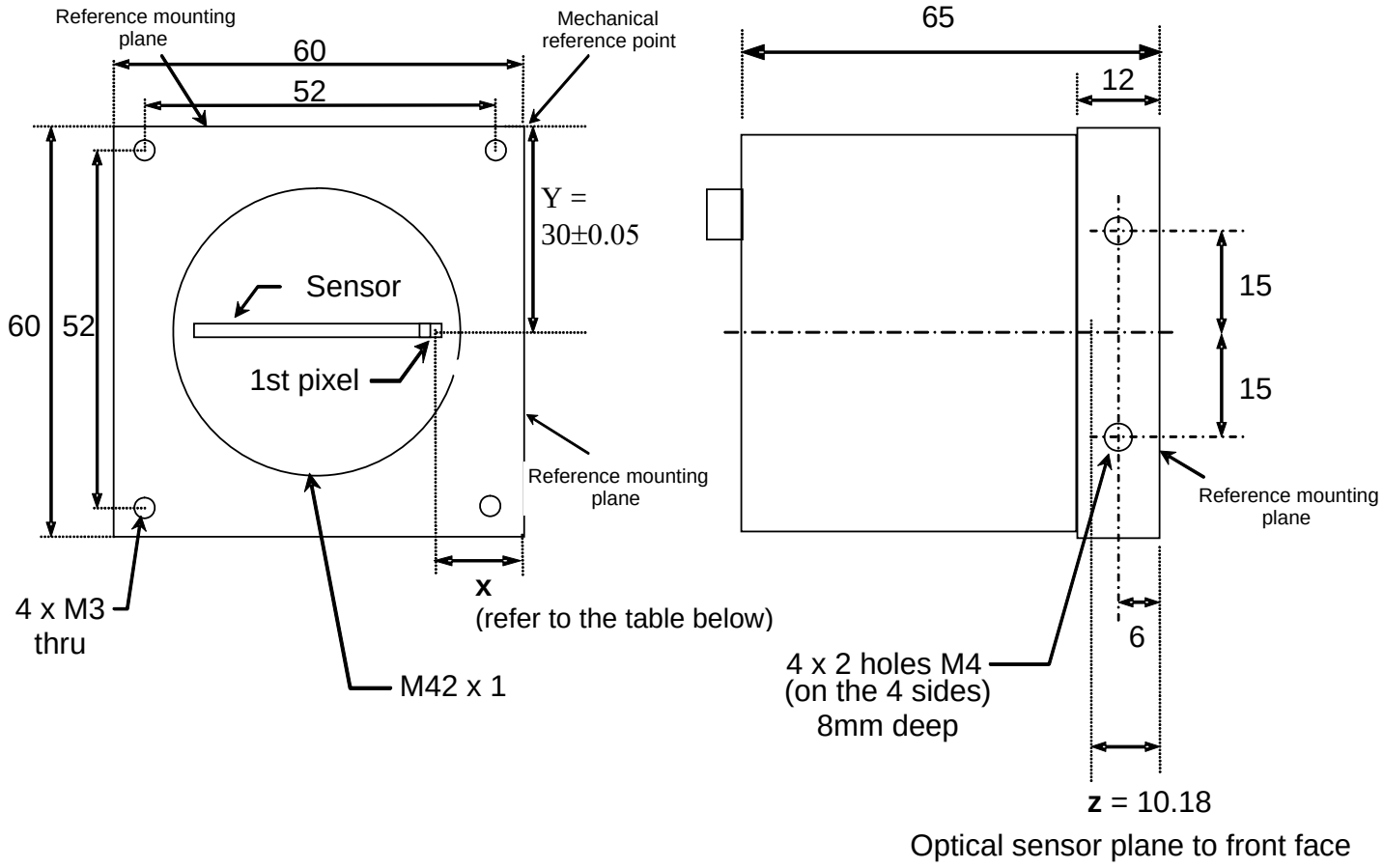
Note: In GEVPLayer, Odd pixels are equivalent to Tap1 and Even pixels are equivalent to Tap2.

2.2 Response of the sensors



3 CAMERA HARDWARE INTERFACE

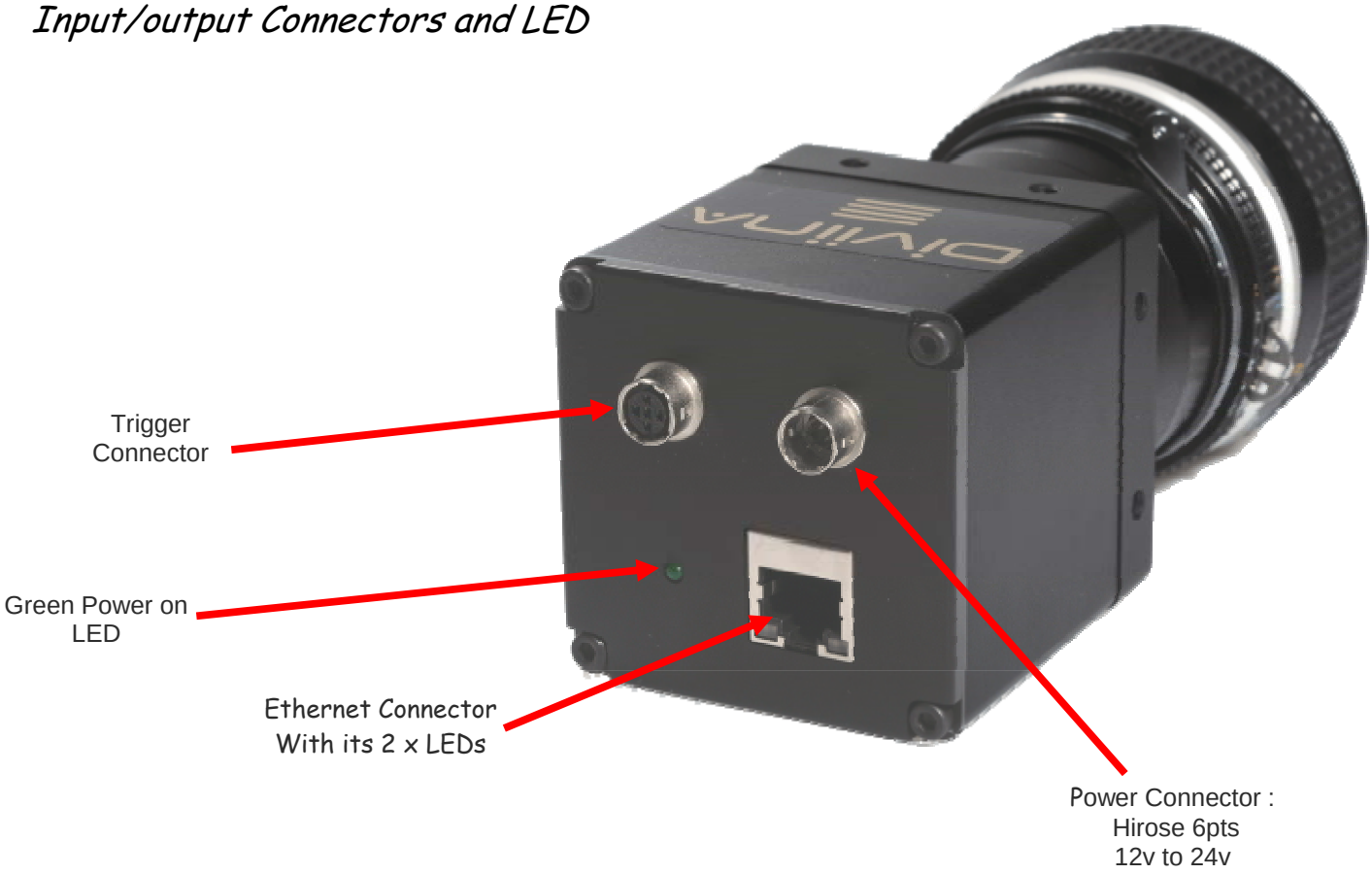
3.1 Mechanical Drawings



3.2 Sensor alignment

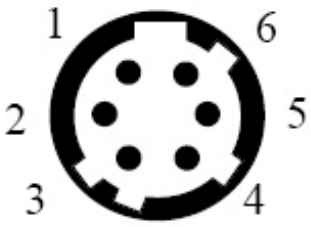
Sensor size (pixels #)	1024	2048	4096
x with 14µm sensor (mm)	20.83	13.66	-
x with 10µm sensor (mm)	22.88	17.76	7.52

3.3 Input/output Connectors and LED



3.3.1 Power Connector

Camera connector type: Hirose HR10A-7R-6PB (male)
Cable connector type: Hirose HR10A-7P-6S (female)



Camera side description

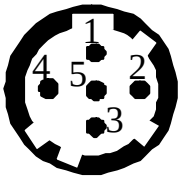
Signal	Pin
PWR	1
PWR	2
PWR	3
GND	4
GND	5
GND	6

Power supply from 12v to 24v

3.3.2 Camera control connector

Camera connector type: Hirose HR10A-7R-5SB
Cable connector type: Hirose HR10A-7P-5P (male)

Signal	Pin
LVDS IN1+ / TTL IN1	1
LVDS IN1-	2
LVDS IN2+ / TTL IN2	3
LVDS IN2-	4
GND	5



Receptacle viewed from camera back

IN1 is connected on Line0 and allows to control external line trigger mode.
IN2 is connected on Line1 and allows to control external frame trigger mode.

3.3.3 Gigabit Ethernet Connector

Camera connector type: RJ45 8pin female

Signal	Pin
MDI_0+	1
MDI_0-	2
MDI_1+	3
MDI_2+	4
MDI_2-	5
MDI_1-	6
MDI_3+	7
MDI_3-	8

4 STANDARD CONFORMITY

The DIVIINA cameras have been tested using the following equipment:

- A shielded power supply cable
- A Ethernet straight cable cat. 6.

e2v recommends using the same configuration to ensure the compliance with the following standards.

4.1 CE Conformity

The DIVIINA cameras comply with the requirements of the EMC (European) directive 89/336/CEE (EN 50081-2, EN 61000-6-2).

4.2 RoHs Conformity

DIVIINA cameras comply with the requirements of the RoHS directive

4.3 GigE Vision Conformity

DIVIINA LM1 cameras comply with the requirement of GigE Vision 1.1 standard.

4.4 GenICam Standard

DIVIINA LM1 cameras comply with the requirement of GenICam 1.0 standard.

4.5 Standard Features Naming Convention (SFNC)

DIVIINA LM1 cameras comply with the requirement of SFNC 1.3 standard.

Warning: Changes or modifications to this unit not expressly approved by the party responsible for compliance could void the user's authority to operate this equipment.

5 GETTING STARTED

5.1 Out of the box

The contains of the Camera box is the following :

There is no CDROM delivered with the Camera : Both User Manual (this document) and GevPlayer control software have to be downloaded from the web site : This ensure you to have an up-to-date version.

Main Camera page : www.e2v.com/cameras

On the appropriate Camera Page (LM1) you'll find a download link first version of GevPlayer compliant is indicated in the last Chapter GEVEPlayer download requires a login/password :

- Login : pleora
- Password : vercors

5.2 Setting up in the system

Vocabulary :

w = size of the sensor line (40,96mm for the 4k 10µm)

FOV = Field Of View (width of the web inspected by the sensor line) in mm.

L = Working distance (from the Lens to the Web) in mm.

f = focal distance of the lens in mm.

S = Speed of the web in mm/s

We have : $\frac{w}{FOV} = \frac{f}{L}$

The ratio M = w/FOV is called Magnification.

The FOV is grabbed by 4096 pixels in the width.

In order to get a ratio of 1 :1 in your image, at the web speed of S, your line rate has to be set :

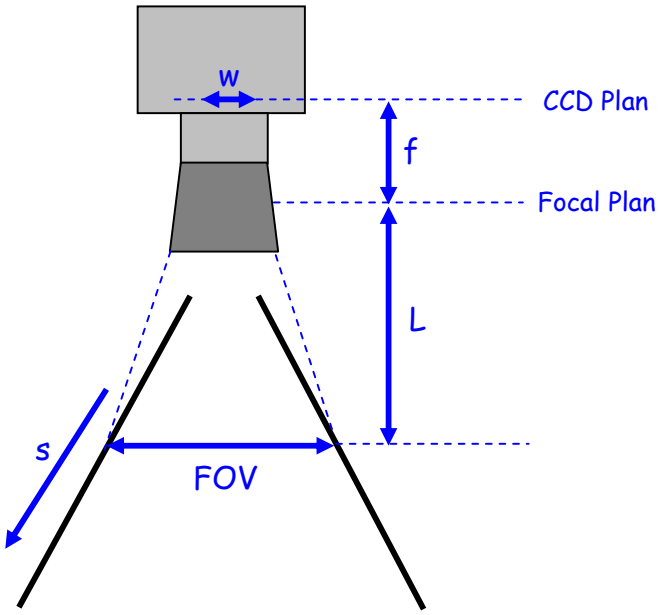
Line Rate = (S/FOV) x 4096

Ex : if the FOV = 11 cm (110mm) and the speed of the web is S= 0,3 m/s (300mm/s) the line rate will be :

Line Rate = (300 /110) x 4096 = 11170 Lines/s.

If you use a 60mm lens, the working distance will be : L = (60 x 110) / 40,96 = 161mm.

This will certainly require a macro lens.



6 CAMERA SOFTWARE INTERFACE

6.1 GigE Vision concepts

Camera interface is compliant with "Gigabit Ethernet Vision" (GigE Vision) or (GEV). GEV normalizes image transport and camera control communications over usual IP networks. Physical GEV carrier has a bandwidth of one gigabit per second (1Gbit/s). GEV is widely used by camera manufacturers and imaging software suppliers.

6.1.1 GenICam

Camera interface is compliant with "Generic Interface for Cameras" (GenICam).
GenICam normalizes the camera control interface with software application. The target is to have a single application controlling cameras from any model and brand the same way.
It introduces the concept of user manual, not for humans but to software application. Application reads this user manual to control cameras.
GenICam has 2 parts, "GenICam Standard" and "GenICam Standard Features Naming Convention" (SFNC)

6.1.2 GenICam Standard

It normalizes the camera control rules. It can be considered as the grammar of the user manual.
From programmer's point of view, all cameras are controlled with the same way by a single Software Developer's Kit (SDK).

6.1.3 SFNC

From vision point of view, camera feature names are standardized by SFNC. It can be considered as the vocabulary of the user manual.

6.2 Getting started with GigE Vision interface

This chapter shows how to connect a GEV camera for the first time. Refer to TBD for more details on GEV interfacing.

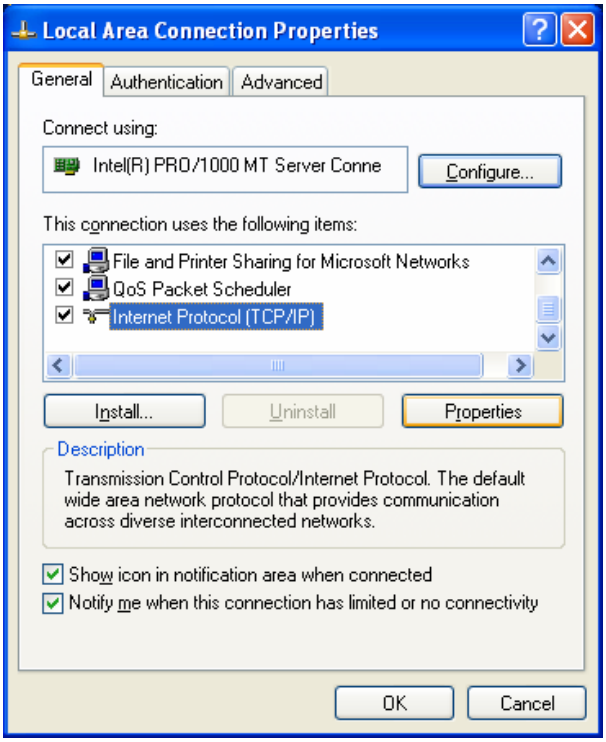
6.2.1 Network setup

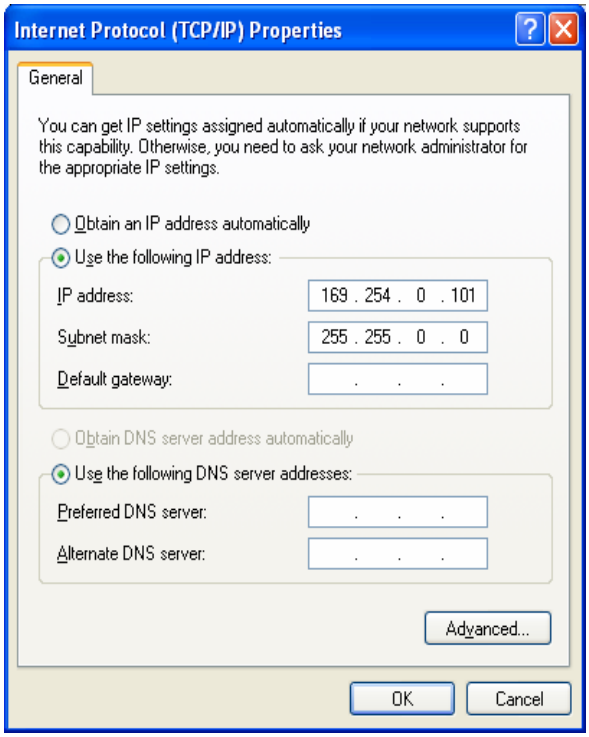
The following is the simplest example of a Gigabit IP network.

A single Ethernet cable is connected in RG45 receptacles of GEV camera and PC. Select a "CAT6" shielded twisted pair quality to get a reliable 1Gbit/s. This cable is available at any computer shop. Recent PC have a gigabit RG45 plug on the motherboard.

Factory setup has set the camera to the default IP subnet169.254.X.X. The PC interface is set to this default IP subnet as follows:
Open the Network interface properties. Settings are shown on Windows XP.

Set TCP-IP v4 interface properties to IP address 169.254.0.101 and subnet mask to 255.255.0.0



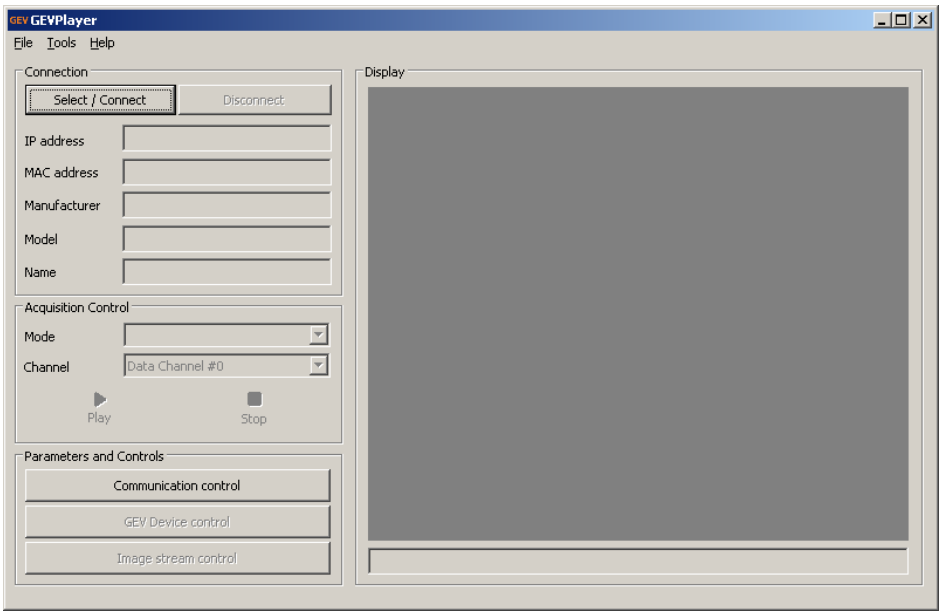


6.2.2 Software installation

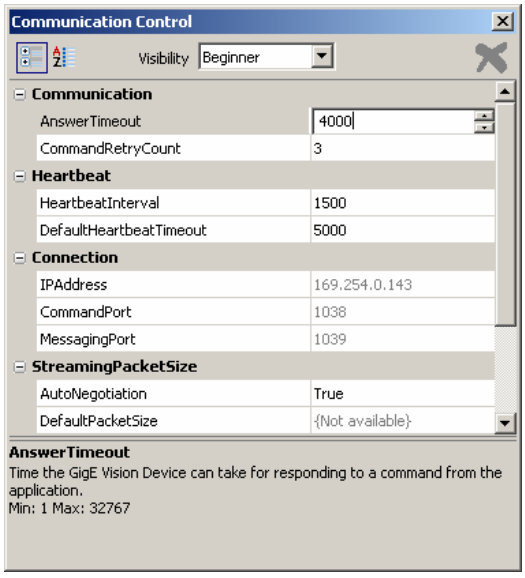
A GigE Vision software is required. Use your own or install PureGEV, downloadable from www.e2v.com site. A PureGEV license is included in camera package. Refer to PureGEV installation manual for instructions. The following assumes Pleora's PureGEV is installed.
To keep things simple, the firewall should be temporarly turned off.

6.2.3 Interactive camera control

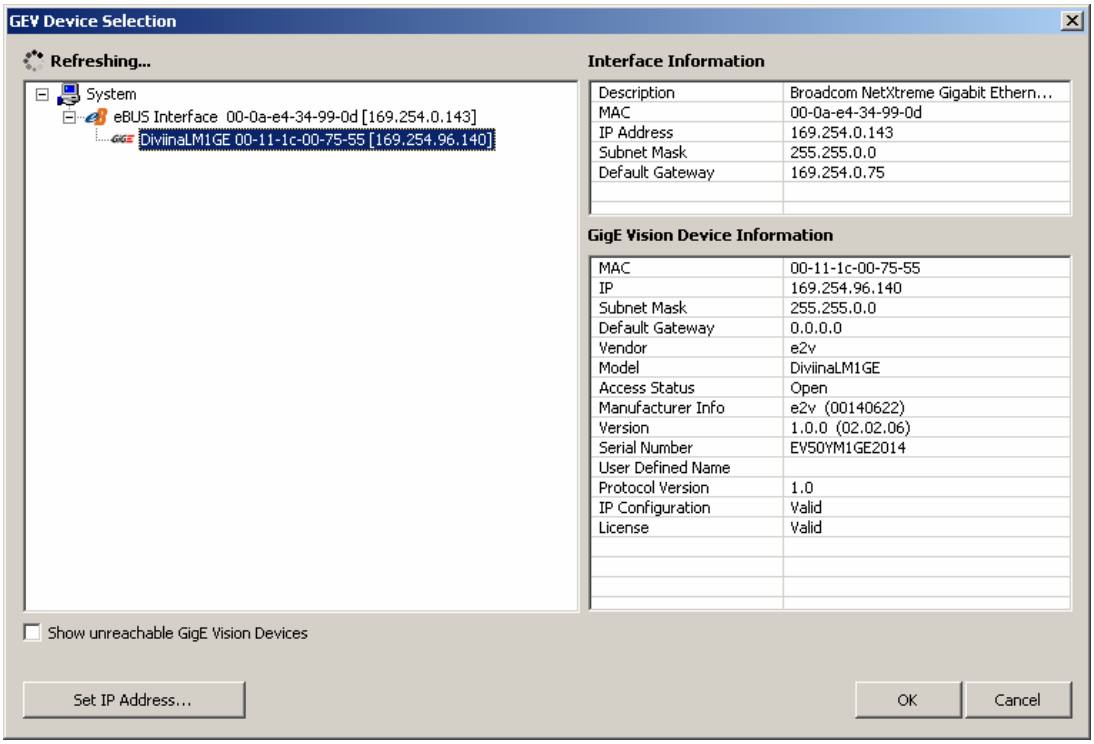
PureGEV Player is used to control camera interactively and display images. :



➢ Click "Communication Control" button and in "Communication Control" window, set the "AnswerTimeout" feature to 4000



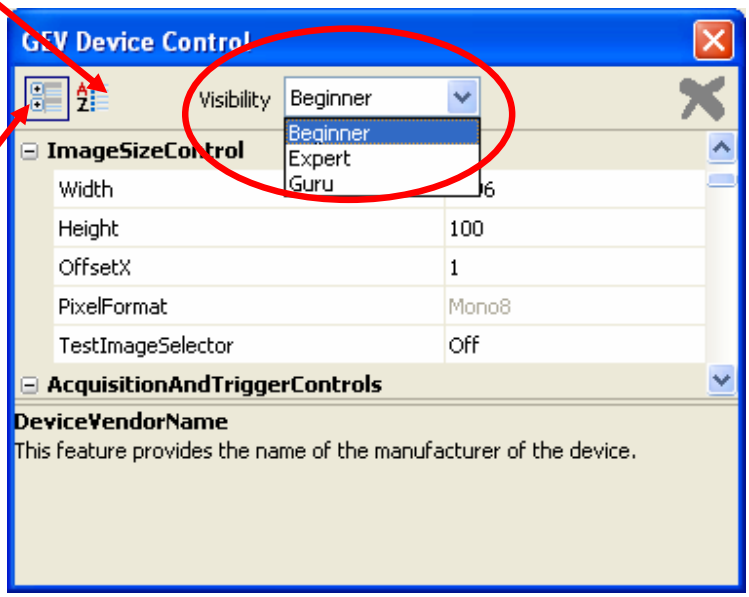
"Select / Connect" button opens the GEV Device Selection window. GigE cameras appears.



Click on camera and check "License" value id "Valid" and click OK. In GEV Player window, "Gev Device control" and "Play" are now active.
Once connected to the Camera you have an easy access to all its features when you click on "GEV DeviceControl". The visibility of these features can be associated to three types of users: Beginner, Expert or Guru. Then you can make life easy for simple users.

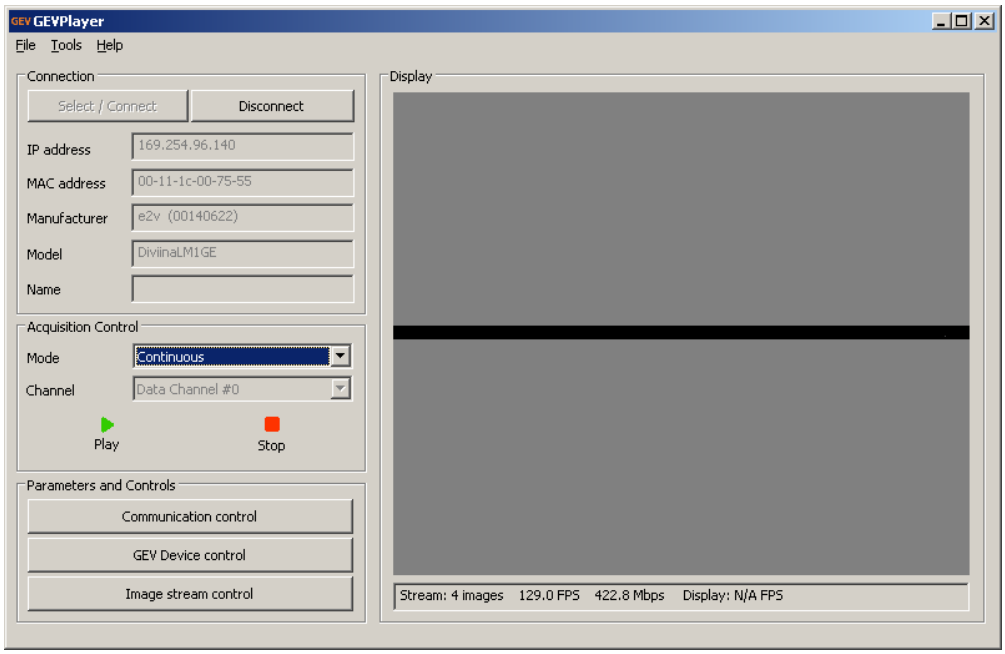
Set Features alphabetically

Set Features inside several items



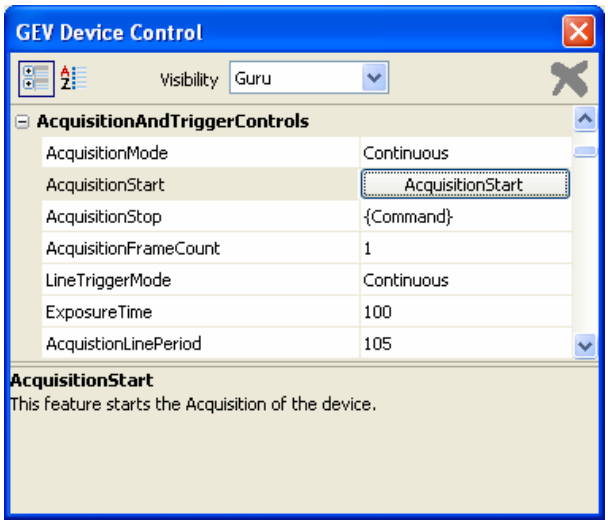
Beginner :The number of features with "Beginner " visibility should be limited to all basics features of the device, and easy to use.
Expert : features that require a more in-depth knowledge of the camera functionality. This is the preferred visibility level for all advance features in the camera.
Guru : Advanced feature that might bring the camera into a state where it will not work properly anymore if it is set incorrectly for the current mode operation.

Click "Play" to start grab. Check camera image on display.



6.2.4 Camera first power on

At the power on of Diviina LM1 camera, controls are generated inside the camera and images are generated without triggers configuration (like in mode free run for a Camera Link camera).
The Acquisition mode is continuous; camera take continuous frame of 100 lines (value by default of Height feature). Each line is acquired in Continuous mode with Exposure time and acquisition line period defined as the minimum Line period of each sensor.



6.3 IP address policy tips

Camera IP address is defined by one of the following policies : LLA, DHCP and fixed IP.
LLA policy is recommended for dedicated GEV links, as no configuration is required except the default subnet setting in PC Ethernet interface. Default subnet is 169.254.X.X.
DHCP policy is recommended when GEV is shared with other Ethernet traffic or when PC/cameras are moved frequently. DHCP can set a dedicated IP address to a given camera.
Fixed IP policy is a simple policy, but not recommended, as address consistency is not insured in time.

7 More

To get further, refer to the following documents, available from http://www.e2v.com/cameras
"iPort PureGEV Quick Start Guide" has more details on network and player.
Frequently Asked Questions (FAQ) are available in our knowledge database.
Reader's comment and customer request are sent to mailto:hotline-cam@e2v.com. Copyright e2v, this paper can be reproduced freely, including this notice. It cannot be sold without written approval.

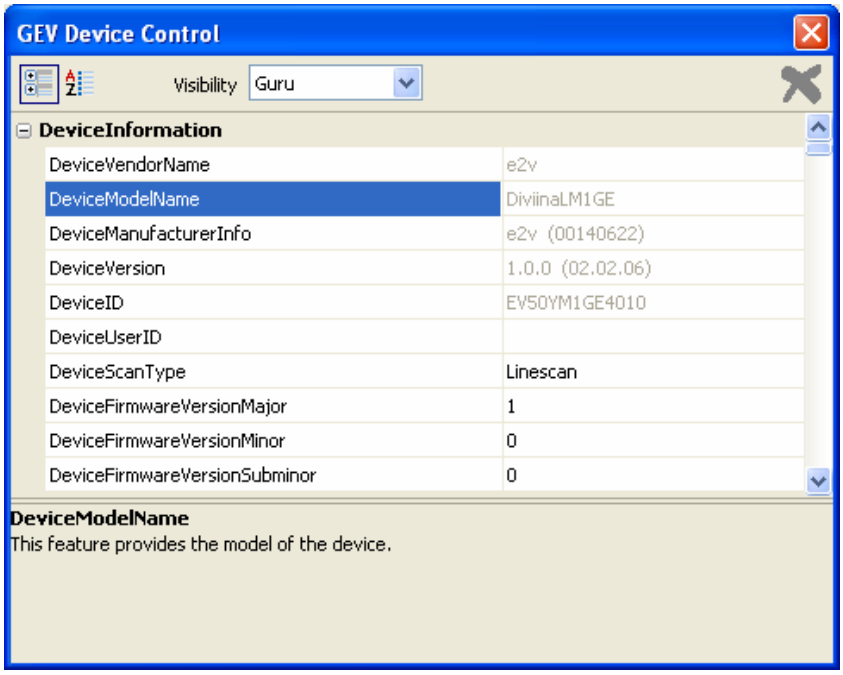
8 Camera Commands

8.1 Device Information

These values allow identifying the Camera. They can be accessed through the GEVPlayer software in the "GevDeviceControl" button. Information of the camera are separated in two parts :

- At the beginning of the list with the section Device information for the information of the e2v camera
- At the end of the list with information relative to the NXT mini

GEV GEVPlayer



All these values are fixed in factory except the Camera User ID which can be fixed by the Customer:

- **DeviceVendorName** "e2v"
  - ⇨ Interface : IString
  - ⇨ Can not be written
  - ⇨ Visibility : Beginner
- **DeviceModelName:** "DiviinaLM1GE"
  - ⇨ Interface : IString
  - ⇨ Can not be written
  - ⇨ Visibility : Beginner
- **DeviceManufacturerInfo** : Part number of the camera
  ex: "EV50YLM1GE4010-BA0"
  - ⇨ Interface: IString
  - ⇨ Can not be written
  - ⇨ Visibility : Beginner

- **DeviceID :** serial number of the Camera
  ex : 0908P0001-AB
  with :
  - "09" : Year of manufacturing
  - "08" : week in the year
  - "P" as Proto, "M" as Manual, "A" as automatic : type of testing
  - "0001" : Identification number
  - AB: Fab indice.

  ⇨ Interface : IString
  ⇨ Can not be written
  ⇨ Visibility : Expert

- **DeviceUserID:** Can be set by the Customer to identify his Camera
  ⇨ Interface : IString
  ⇨ Can be written
  ⇨ Visibility : Expert

- **DeviceScanType:** This feature specifies the scan type of the sensor.
  ⇨ Interface : IEnumeration
  - Choice : "Linescan" is the factory value
  - Choice : "Areascan" is used when customer wants to trig the frame with the Programmable Logic Controleur (PLC) of the camera.

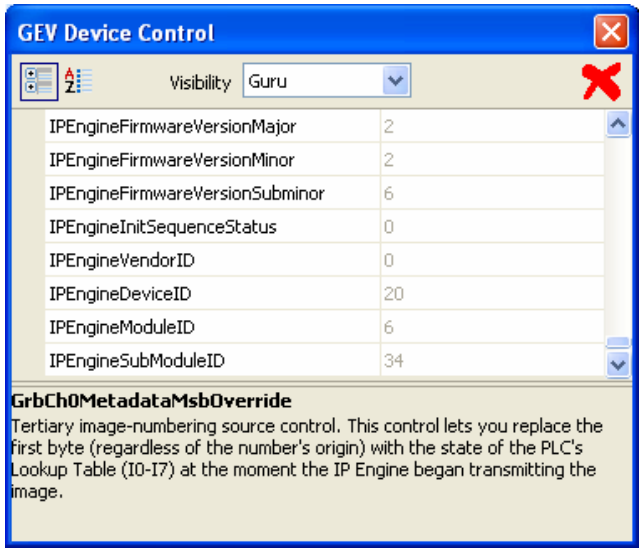
  ⇨ Can be written
  ⇨ Visibility : Beginner

- **DeviceFirmwareVersionMajor :** Can be get by the Customer to identify the Major Version of the Firmware Camera.
  ⇨ Interface : IString
  ⇨ Can not be written
  ⇨ Visibility : Beginner

- **DeviceFirmwareVersionMinor:** Can be get by the Customer to identify the Minor Version of the Firmware Camera.
  ⇨ Interface : IString
  ⇨ Can not be written
  ⇨ Visibility : Beginner

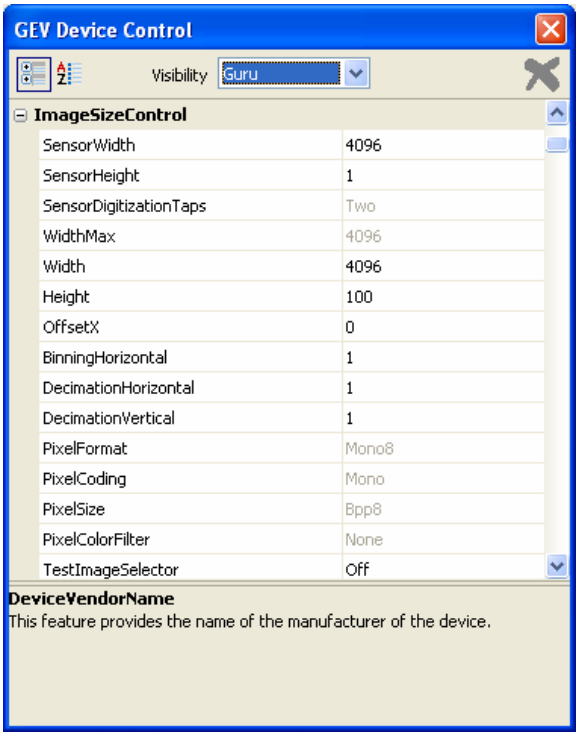
- **DeviceFirmwareVersionSubMinor:** Can be get by the Customer to identify the SubMinor Version of the Firmware Camera.
  ⇨ Interface : IString
  ⇨ Can not be written
  ⇨ Visibility : Beginner

Note : Some additional information are available at the end of the GEVDeviceControl windows relative to the Pleora IP engine.



GEV GEVPlayer

8.2 *Image size control*



GEV GEVPlayer

- **SensorWidth:** *Gives the maximum effective width of the sensor. For exemple a 4k sensor has a sensor width of 4096 pixels.*
  - ⇨ Interface : IInteger
  - ⇨ Unit : pixels
  - ⇨ Can not be written
  - ⇨ Visibility : Expert

- **SensorHeight** : gives the maximum effective height of the sensor. A linescan camera has only one line.
  - ⇨ Interface : IInterger
  - ⇨ Unit : pixels
  - ⇨ Can not be written
  - ⇨ Visibility : Expert

- **SensorDigitalisationTaps** : Gives the number of tap of the camera sensor. LM1 Camera has 2 taps.
  - ⇨ Interface: IEnumeration
  - ⇨ Can not be written
  - ⇨ Visibility : Expert

- **Width** : this feature represents the actual image width expelled by the camera. It can be defined from 1 to the maximal sensor width.
  - ⇨ Interface: IInteger
  - ⇨ Unit : pixels
  - ⇨ Values available: From 1 to SensorWidth
  - ⇨ Can be written
  - ⇨ Visibility : Beginner

- **Height** : this feature represents the actual image height expelled by the camera.
  - ⇨ Interface: IInteger
  - ⇨ Unit : pixels
  - ⇨ Values available : From 1 to 16384
  - ⇨ Can be written
  - ⇨ Visibility : Beginner

- **OffsetX:** this feature represents the horizontal offset from the origin of the AOI (Area Of Interest). It can be defined from 1 to the maximal sensor width.
  - ⇨ Interface: IInteger
  - ⇨ Unit : pixels
  - ⇨ Values available: From 1 to SensorWidth
  - ⇨ Can be written
  - ⇨ Visibility : Beginner

- **BinningHorizontal** : this feature represents the horizontal photo sensitive cells that must be combined together. A value of one indicates that no horizontal binning is performed by the camera.
  - ⇨ Interface: IInteger
  - ⇨ Can not be written
  - ⇨ Visibility : Expert

- **DecimationHorizontal:** this feature allows horizontal sub-sampling of the image. A value of one indicates that the camera performs no horizontal decimation.
  - ⇨ Interface: IInteger
  - ⇨ Can not be written
  - ⇨ Visibility : Expert

- **DecimationVertical** :this feature allows vertical sub-sampling of the image. A value of one indicates that the camera performs no horizontal decimation.

- ⇨ Interface: IInteger
- ⇨ Can not be written
- ⇨ Visibility : Expert

- **PixelFormat:** this feature indicates the format of the pixel to use during the acquisition. LM1 camera is a 8 bit camera so the available format is Mono8.
  - ⇨ Interface : IEnumeration
  - ⇨ Can not be written
  - ⇨ Visibility : Beginner

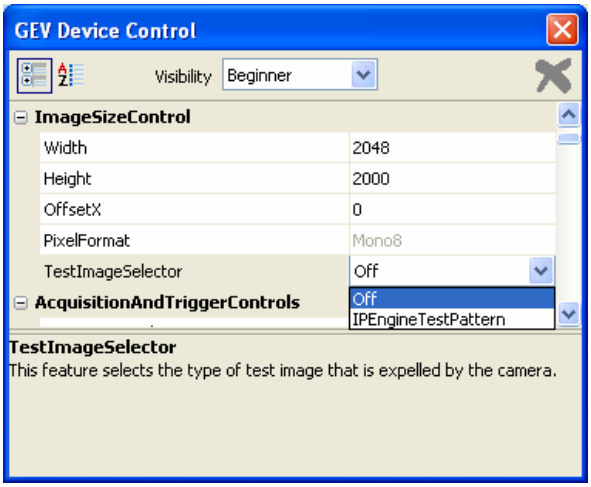
- **PixelCoding :** this feature indicates the coding of the pixel in the image. LM1 camera is a 8 bit camera so the available pixel coding is Mono.
  - ⇨ Interface : IEnumeration
  - ⇨ Can not be written
  - ⇨ Visibility : Expert

- **PixelSize:** this feature indicates the total size in bits of a pixel of the image. LM1 camera has a bit depth of 8 bits.
  - ⇨ Interface : IEnumeration
  - ⇨ Can not be written
  - ⇨ Visibility : Expert

- **PixelColorFilter :** this feature indicates the type of color filter that is applied to the image. LM1 camera is a black and white linescan camera whitout color filter.
  - ⇨ Interface : IEnumeration
  - ⇨ Can not be written
  - ⇨ Visibility : Expert

- **TestImageSelector :** Defines if the data comes from the Sensor or the FPGA (test Pattern). This command is available in "Image Size Control" section of the GEV Device Control :

GEV GEVPlayer



  - ⇨ Interface : IEnumeration

- Choice "Off" to switch to CCD image sensor
- Choice "IPEngineTestPattern" to switch to Test Pattern.

⇨ Can be written

⇨ Visibility : Expert

The Test pattern is a single ramp. The test pattern is generated in the FPGA: It's used to point out any interface problem with the application.

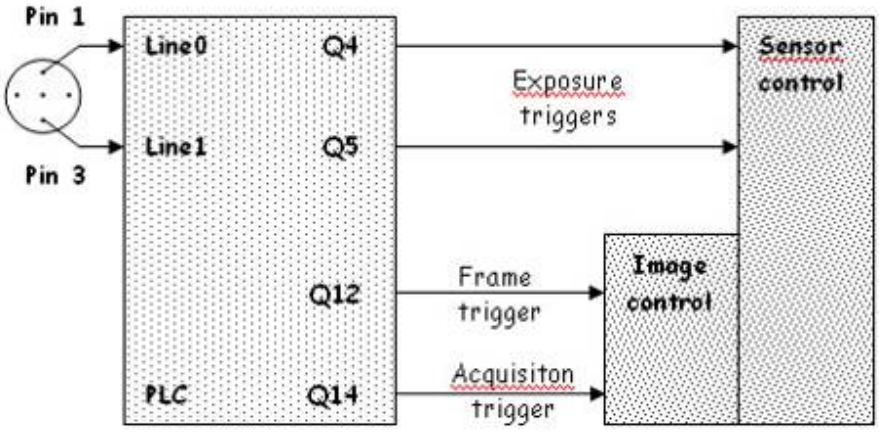
The test pattern is a 8bit width pattern composed with several ramps from 0 to 255 all along the whole Camera definition. Then the number of ramps depends on the number of pixels of the Camera

Test patterns are detailed in Appendix A.

8.3 Acquisition and trigger controls

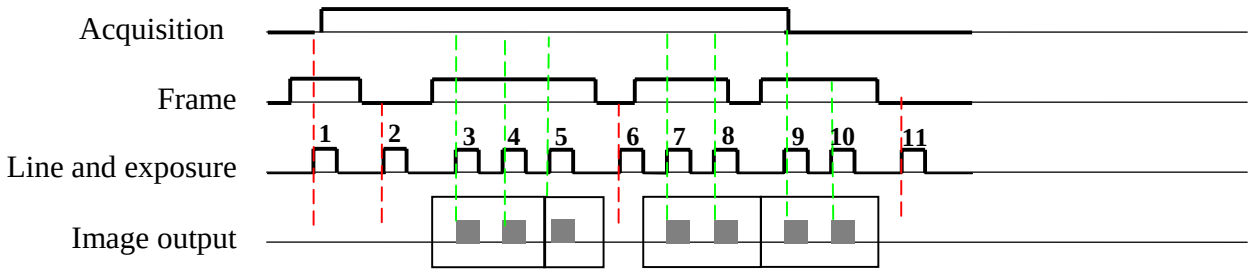
8.3.1 Camera Trigger synoptics

External triggers on receptacle pins are feeding PLC line1 and Line2. Q4 and Q5 are driving exposure triggers. Q12 is driving Frame trigger and Q14 is driving acquisition trigger.
By convention, Pin1 has the exposure trigger, Pin2 is available for others triggers and data input.



8.3.2 Acquisition and Trigger modes

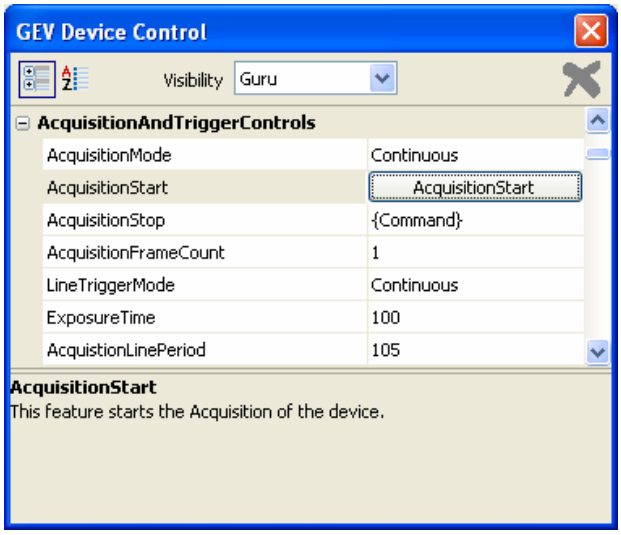
Acquisition, Frame and Line can be triggered by internal or external signals.
Genicam camera has 4 real time controls: Line, exposure, frame and acquisition.
An **acquisition** is defined as the capture of a sequence of one or many **frames** witch is also a capture of one or many **lines**. For each line an **exposure** time and an acquisition line period are controlled.



In the example above. We have an acquisition of 2 lines – Frames.

- ⇨ Trig 1 is not taken in account because the acquisition was not started.
- ⇨ Trig2 is not taken in account because the Frame 1 is not yet valid.
- ⇨ Trig3 & 4 are OK for the Frame 1
- ⇨ Trig5 is taken in an additional Frame 1 completed in 1 line because the Frame signal ends.
- ⇨ Trig6 is not taken in account because Frame 2 is not yet valid
- ⇨ Trig7 & 8 are OK for the Frame 2
- ⇨ Trig9 & 10 are OK for the Frame 3 : The Frame has started before the acquisition ends then the Frame has to be finished.
- ⇨ Trig 11 is not taken in account because the Frame and the acquisition are not valid.

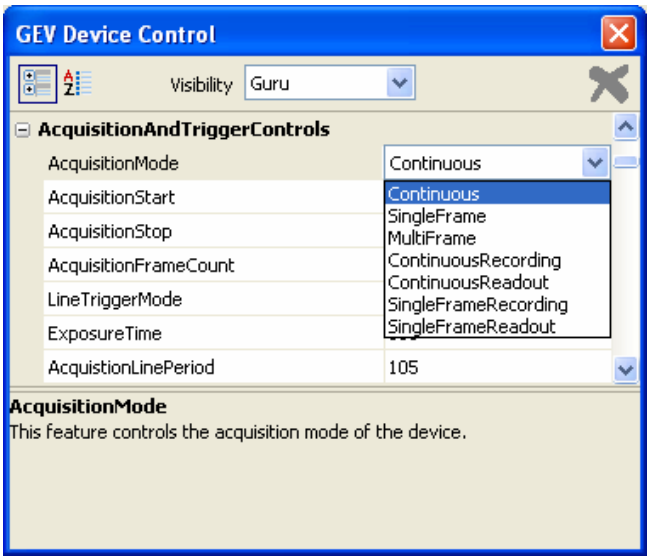
GEV GEVPlayer



- **AcquisitionMode** : this feature controls the acquisition mode of the device.
  - ⇨ Interface : IEnumeration
    - Choice : "Continuous" : Frames are captured continuous from **AcquisitionStart** command until **AcquisitionStop** command.
    - Choice : "Single Frame" to capture one frame
    - Choice : "MultiFrame" the number of frames specified by **AcquisitionFrameCount** is captured

    Inside Diviina GigE a memory is available to record either one or many frame, the choice below allow customer to use this feature :
    - Choice : "ContinuousRecording" : record continuously frame
    - Choice : "ContinuousReadout" : gives the frame inside the memory continuously
    - Choice : "SingleFrameRecording" : record one frame.
    - Choice : "SingleFrameReadout" : gives the frame stocked inside memory
  - ⇨ Can be written
  - ⇨ Visibility : Beginner

GEV GEVPlayer



- **AcquisitionStart:** this command starts the acquisition of frame.

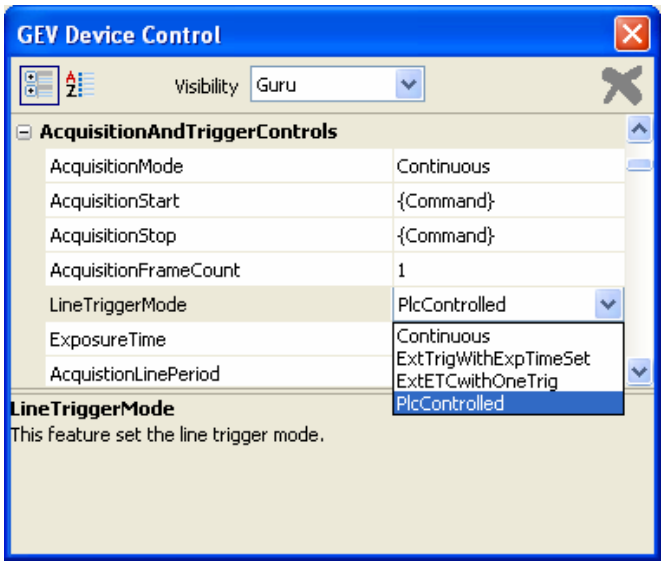
- ⇨ Interface : ICommand
- ⇨ Can be written
- ⇨ Visibility : Beginner

- **AcquisitionStop:** this command stops the acquisition of image(s) at the end of the current frame.
  - ⇨ Interface : ICommand
  - ⇨ Can be written
  - ⇨ Visibility : Beginner

- **AcquisitionFrameCount** : this feature gives the number of frames to be acquired in **MultiFrame** mode.
  - ⇨ Interface : IInterger
  - ⇨ Unit : frame
  - ⇨ Values available: from 1 to 255
  - ⇨ Can be written
  - ⇨ Visibility : Beginner

- **LineTriggerMode** : this custom feature set ***pre-defined line acquisition mode***. Those modes are the same as those well known of e2v camera link camera.
  - ⇨ Interface : IEnumeration
    - Choice : "Continuous" is like "Free Run mode", Exposure and Line period are set in the camera with features, **Exposure** and **AcquisitionLinePeriod**.
    - Choice : "ExtTrigWith ExpTimeSet" : an external trigger starts exposure time and the value of **Exposure** feature gives the exposition time.
    - Choice : "ExtETCwithOneTrig" : Both exposure time and line period are defined by a Trig signal.
    - Choice : "PlcControlled" gives opportunity to use all Pleora GPIO possibilities available inside Diviina GigE camera.
  - ⇨ Can be written
  - ⇨ Visibility : Beginner

GEV GEVPlayer



Line trigger mode is detailed in Appendix C.

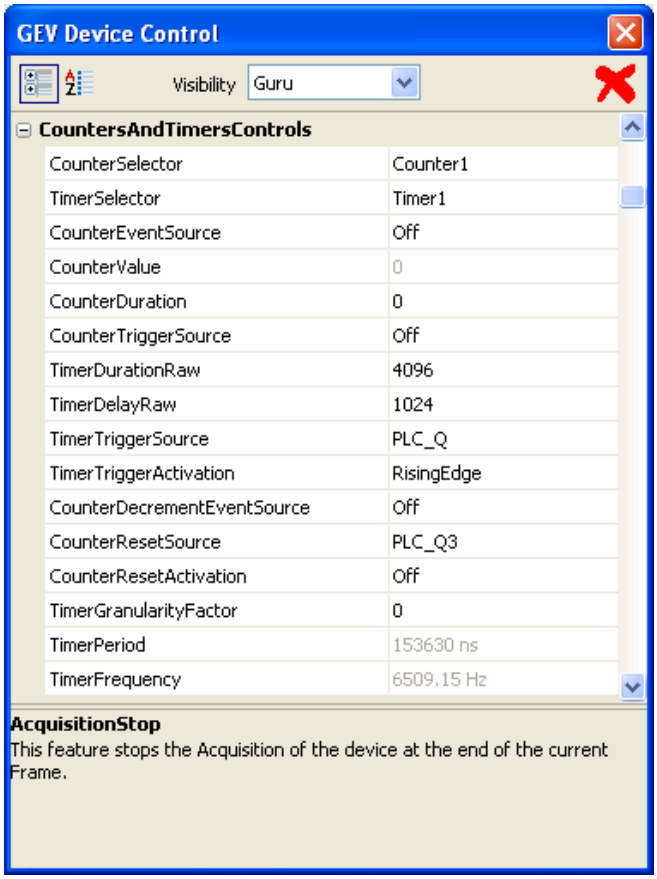
- **ExposureTime :** this feature fixes the exposure time when **lineTriggerMode** selected is Continuous, or ExtTrigWithExpTimeSet(otherwise it's ignored).
  - ⇨ Interface : IInteger
  - ⇨ Unit : Microseconds
  - ⇨ Values available : From 4 to 65534
  - ⇨ Can be written
  - ⇨ Visibility : Beginner

- **AcquisitionLinePeriod :** this feature fixes the line period when **lineTriggerMode** selected is Continuous (otherwise it's ignored).
  - ⇨ Interface : IInteger
  - ⇨ The minimum of Line period depends of sensor width :
    - 28µs for the 1K Pixels cameras (35,714kHz)
    - 55µs for the 2K pixels cameras (18,182kHz)
    - 105µs for the 4k pixels cameras (9,523 kHz)
  - ⇨ The maximum line period is 65535.
  - ⇨ Unit : Microseconds
  - ⇨ Can be written
  - ⇨ Visibility : Beginner

The **AcquisitionLinePeriod** *min value is not displayed in GevPlayer for each camera but any attempt to set to a lower value then this will be refused by the camera.*

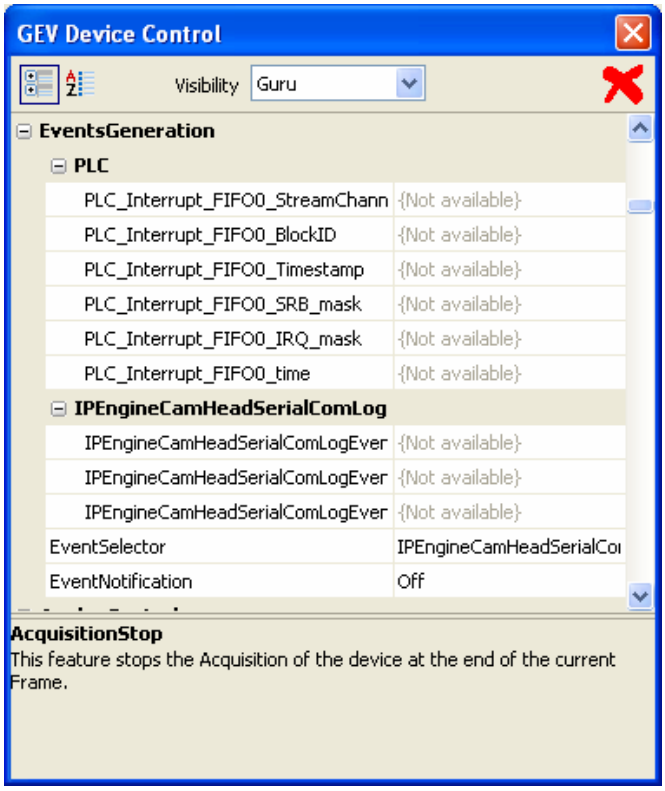
In the same way, it's impossible to set the line period at a lower value than the exposure time. Note that if the exposure time is increased and set at a lower value than the line period, this last one will be automatically adjusted at the value of the exposure time : This modification won't appear in GevPlayer without disconnect/reconnect

8.4 Counters and timers controls



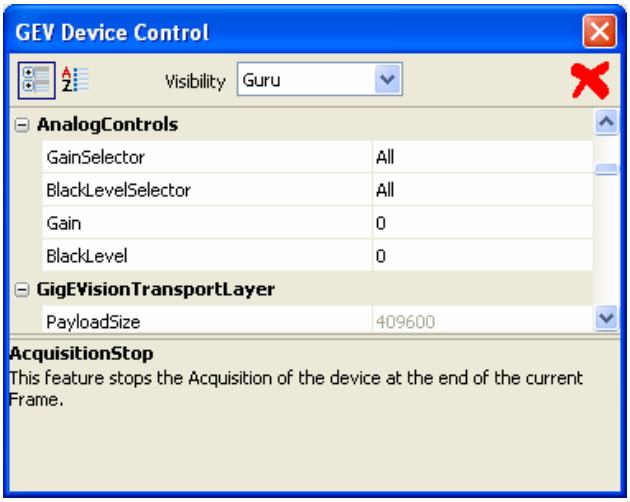
All those parameters are allowed to control the 4 timers available inside the camera. Those timers are available when PlcControlled is selected into LineTriggerMode feature.
To get further, refer to the following documents, available from http://www.e2v.com.
"Programmable Logic Controller, Reference Guide" in section Enhanced Function Block has more details on those parameters.

8.5 Event generation



This Pleora IPEngine is detailed in the "Programmable Logic Controller, Reference Guide".

8.6 Analog controls



- **GainSelector** : this feature allows to choice the tap of the sensor where gain is applied :
  - ⇨ Interface : IEnumeration
    - Choice : "All" to modify in the same time gain of Tap1 and gain of Tap2 of the sensor.
    - Choice : "Tap1" " to modify only gain ofTap1 (Odd pixels) of the sensor.
    - Choice : "Tap2" to modify only gain ofTap2 (Even pixels) of the sensor.
  - ⇨ Can be written
  - ⇨ Visibility : Beginner

- **BlackLevelSelector** : this feature allows to choice the tap of the sensor where offset is applied :
  - ⇨ Interface : IEnumeration
    - Choice : "All" to modify in the same time offset of Tap1 and gain of Tap2 of the sensor.
    - Choice : "Tap1" " to modify only offset ofTap1 of the sensor.
    - Choice : "Tap2" to modify only offset ofTap2 of the sensor.
  - ⇨ Can be written
  - ⇨ Visibility : Beginner

- **Gain** : This feature controls the selected gain as an absolute physical value.
  - ⇨ Values available from 0 to 880 corresponding to a Gain range of 0 to 31dB (by step of 0,0351dB)
  - ⇨ Interface : IInteger
  - ⇨ Unit : None
  - ⇨ Can be written
  - ⇨ Visibility : Beginner

- **BlackLevel** : This feature controls the selected analog black level as an absolute physical value.
  - ⇨ This represents a DC offset applied to the video signal.
  - ⇨ Interface : IInteger
  - ⇨ Values available are from 0 to 255 which is equivalent to 16 LSB by steps of 0,063 LSB (8 bits)
  - ⇨ Unit : LSB
  - ⇨ Can be written
  - ⇨ Visibility : Beginner

- **AdaptativeTapBalance :** This custom feature enables the Adaptative Tap balance.
  - ⇨ Interface : IBoolean
  - ⇨ Can be written
  - ⇨ Visibility : Beginner

How works the Adaptative Tap Balance ?

The Auto Tap Balance is a Laplace filter which is applied in the FPGA. It automatically solve any odd/even mismatch that can be visible in the image

- Whatever the action you may have on the Odd/even Tap Gains to increase the mismatch between the Taps, the filter will correct if enabled
- The filter has to be disabled if the inspection is done at **Nyquist** frequency : Then the tap balance has to be performed by using odd and even Tap Gains.

The Camera is delivered with the Adaptative Tap Balance disabled by default.

Gains Management and Auto Tap Balance

The Selected Gain All is a "virtual" global command which affects both Odd and Even Gains in the same time.

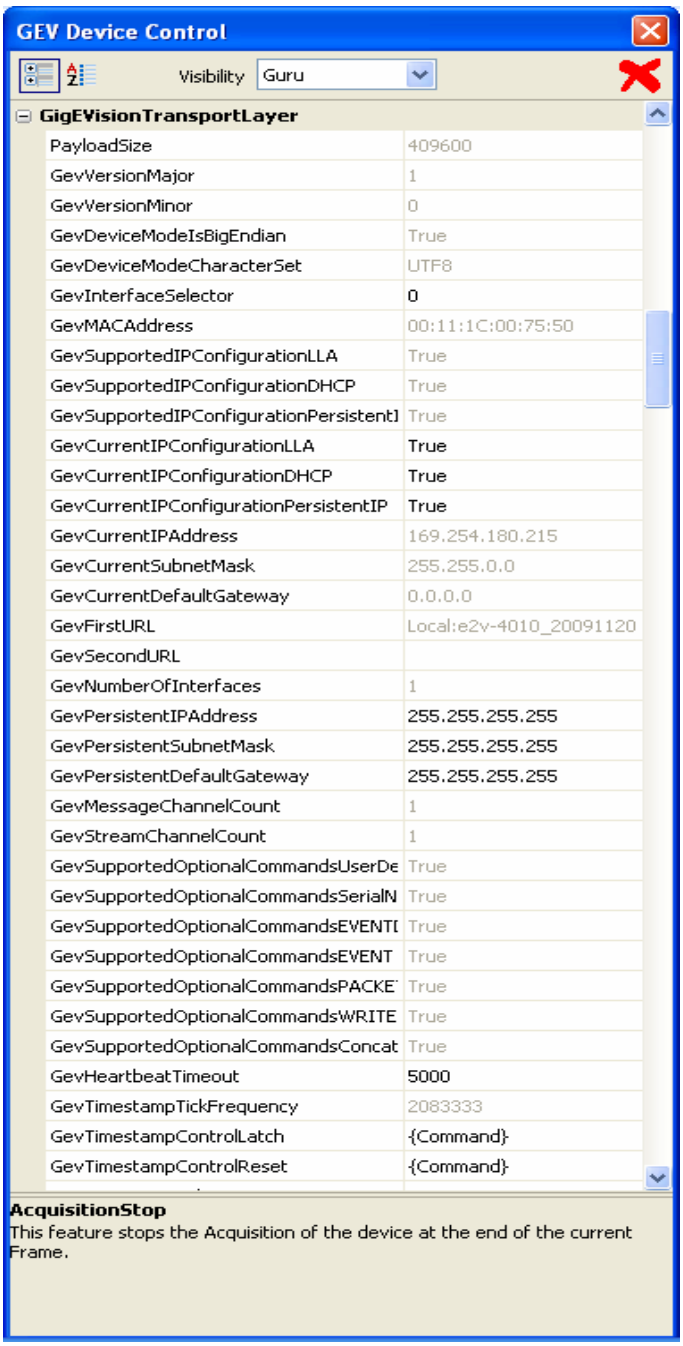
Each value set in the Selected Gain All erases Odd and Even Gain values.

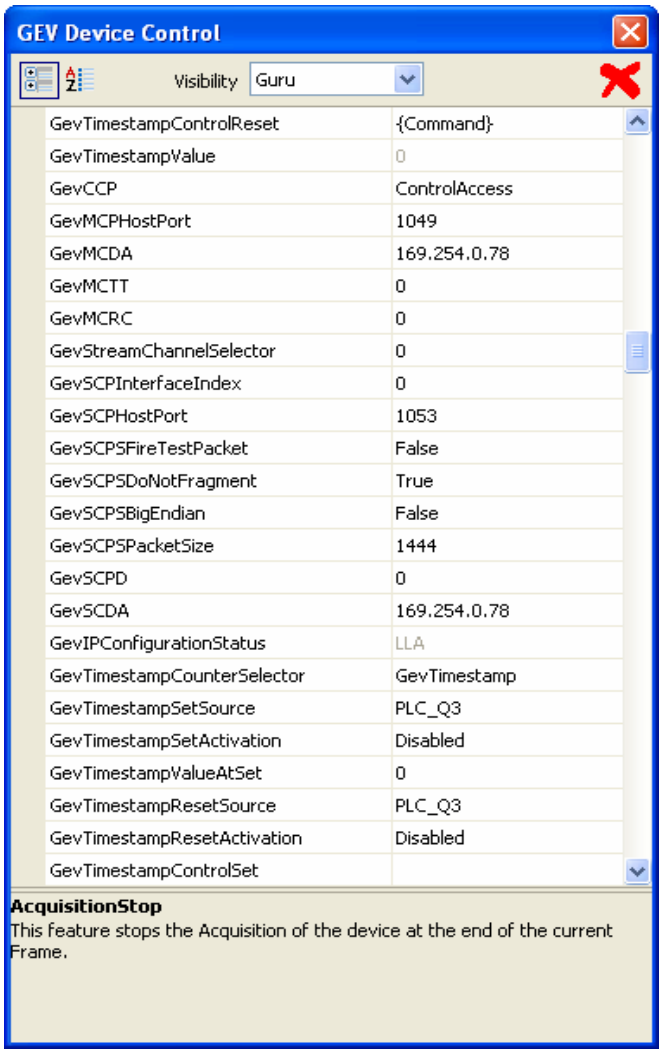
This gain has to be used when the Auto Tap balance is activated as a "friendly" mode to set quickly the gain level in the Camera without taking care of the Tap balance which is automatically done by the Laplace filter.

- The real values of gain applied on each Tap are those set in the odd and even Gain parameters.
- Whatever the action you may have on the Odd/even Tap Gains to increase the mismatch between the Taps, the filter will correct if enabled
- In CommCam the odd/gains Values are not refreshed after the setting of the Global gain command : You have to refresh them individually with a right click on the value.

8.7 GigE vision transport layer

All Gigabit Ethernet Vision (GEV) features in this chapter are compliant with GEV version 1.1 and GenICam Standard Feature Naming Convention (SFNC) version 1.3.
The 6 main GEV features described here are enough for successful network configuration.
Please refer to SFNC document for more features.





- **GevCurrentIPConfigurationDHCP** : Controls DHCP search. This setting reduces boot time by 12s.
  - ⇨ Interface : IBoolean
    - Choice : "True" only when a local DHCP server will handle camera IP settings.
    - Choice : "False" " otherwise.
  - ⇨ Can be written
  - ⇨ Visibility : Beginner

- **GevCurrentIPConfigurationPersistentIP**: Disables hard IP address setting. Camera is automatically set in default IP address subnet : 169.254.X.Y. This setting insures IP subnet consistency, prevents IP address conflicts and prevents camera discovery failure.
  - ⇨ Interface : IBoolean
    - Choice : "True" to enable Persistent IP
    - Choice : "False" " otherwise.
  - ⇨ Can be written
  - ⇨ Visibility : Beginner

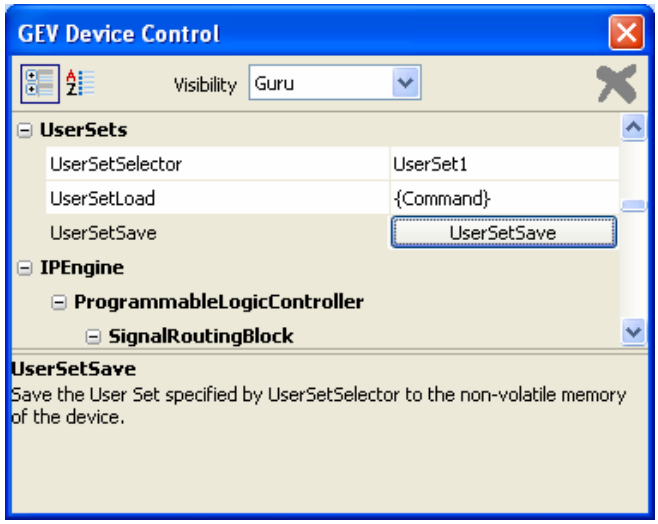
- **GevSCDA**: Defines the destination IP address of image stream. Default is the control PC address. Adjusts address when grabbing PC is separated from the control. Multicast and broadcast address ranges are available for distributed machine vision
  - ⇨ Interface : IInteger
  - ⇨ Can be written
  - ⇨ Visibility : Guru

- **GevSCPHostPort**: Destination Port of image stream. Adjusted to fit the grabbing PC port.
  - ⇨ Interface : IInteger
  - ⇨ Can be written
  - ⇨ Visibility : Guru

8.8 User Sets

The settings of the Camera can be saved in one User bank.
The Factory default settings can be load from its dedicated memory bank.

GEVPlayer



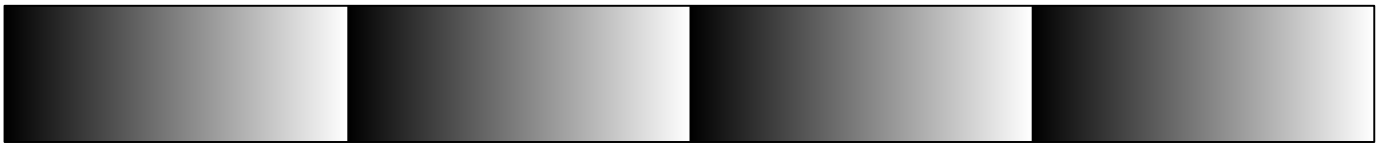
- **UserSetSelector:** This feature give choice of witch memory is selected.
  - ⇨ Interface : IEnumeration
    - Choice "Default" : selected for load the factory settings
    - Choice"UserSet1" : selected for save and load customer settings
  - ⇨ Can be written
  - ⇨ Visibility : Beginner
- **UserSetLoad** : Load the User Set specified by "UserSetSelector" to the device and makes it active.
  - ⇨ Interface : ICommand
  - ⇨ Can be written
  - ⇨ Visibility : Beginner
- **UserSetSave** : Save the User Set when UserSet1 is specified by "UserSetSelector" to the device.
  - ⇨ Interface : ICommmand
  - ⇨ Can be written
  - ⇨ Visibility : Beginner

A synthesis of all camera features is available on APPENDIX D.

9 APPENDIX A: Test Patterns

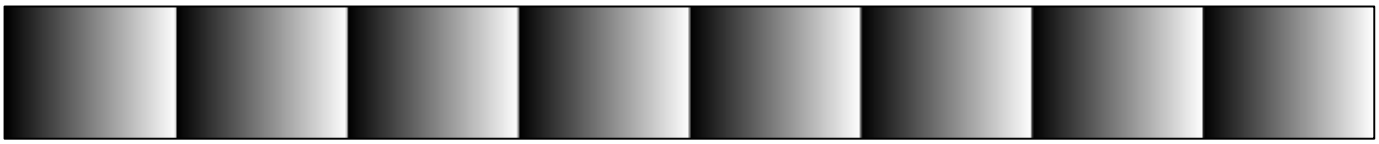
9.1 1024 Pixels Camera

The test pattern is composed of 4 successive ramps from 0 to 255 LSB gray values :



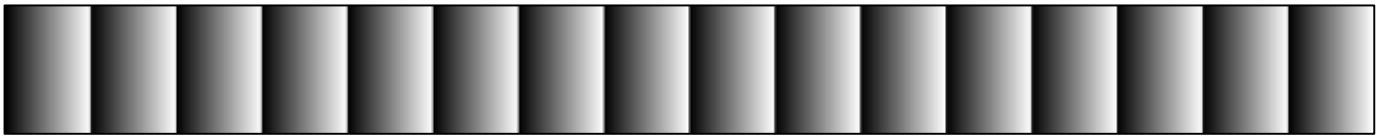
9.2 2048 Pixels Camera

The test pattern is composed of 8 successive ramps from 0 to 255 LSB gray values :



9.3 4096 Pixels Camera

The test pattern is composed of 16 successive ramps from 0 to 255 LSB gray values :

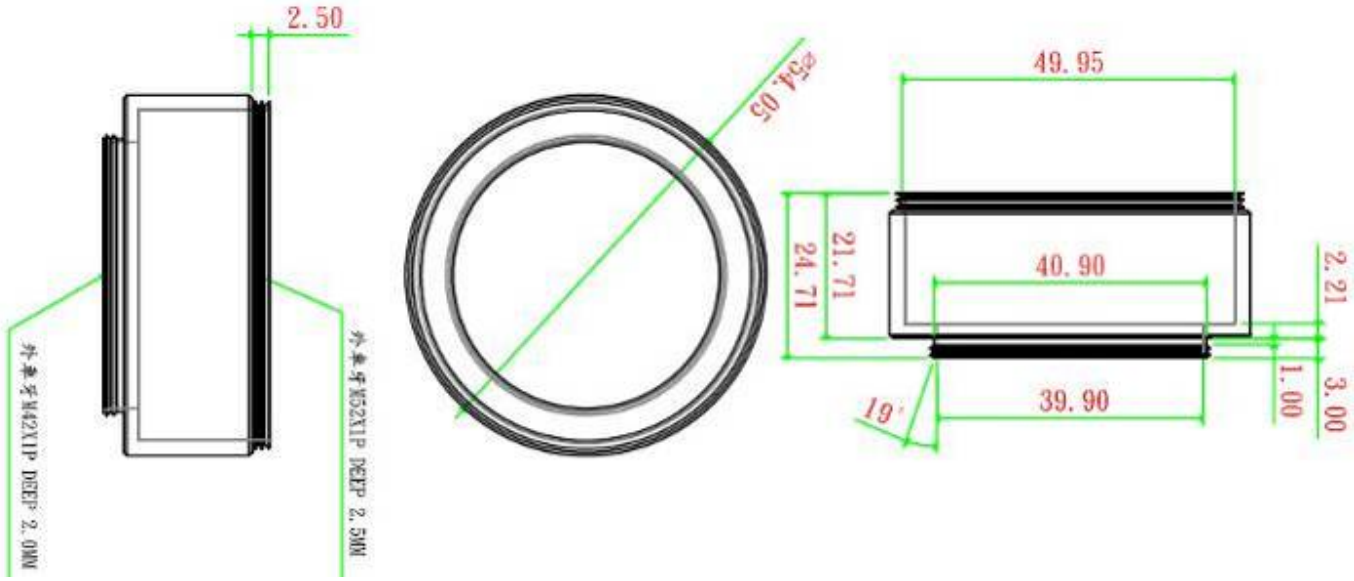


10 APPENDIX B: Optical Mounts available

10.1 F-Mount

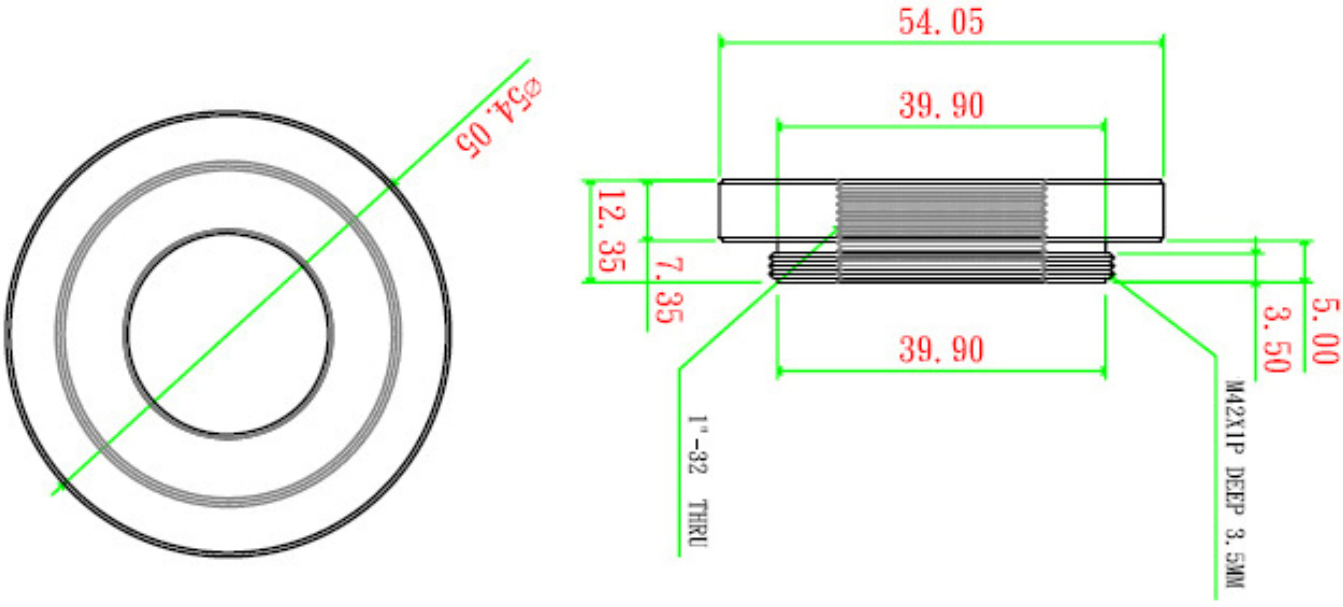
F Mount: (Part number EV50-MOUNT-F)

Drawing for the additional part (except Nikon BR3) :



10.2 C-Mount

C Mount : (Part number EV50-MOUNT-C)



11 APPENDIX C : LINE TRIGGER MODE

This Appendix describes the custom feature of LM1 : LineTriggerMode. Feature allows to easier and quicker control camera. The 3 choices of feature are explained below, if you need more information about these, a FAQ on each mode is available with downloadable file from www.e2v.com site.

Timing Specifications

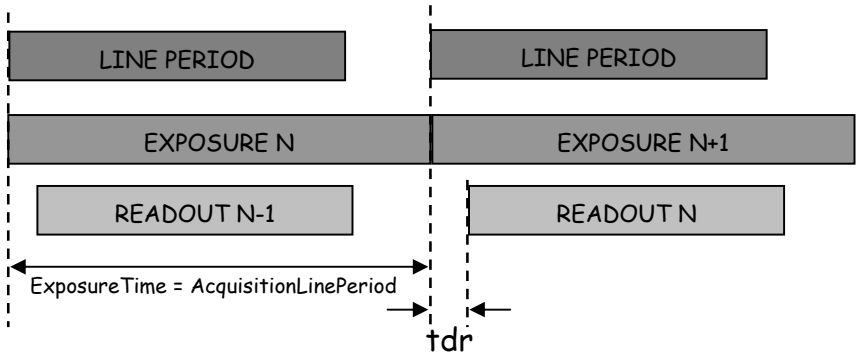
This table is for all the synchronization modes.

Label	Description	Value
Td	Q4 rising to integration period start delay	350ns
Tdr	Integration period stop to readout	1,8µs
Th	Q4 hold time (pulse high duration)	1,1µs
td1	Q4/Q5 falling/rising to integration period start delay	350ns
td2	Q4/Q5 rising to integration period stop delay	1,3µs

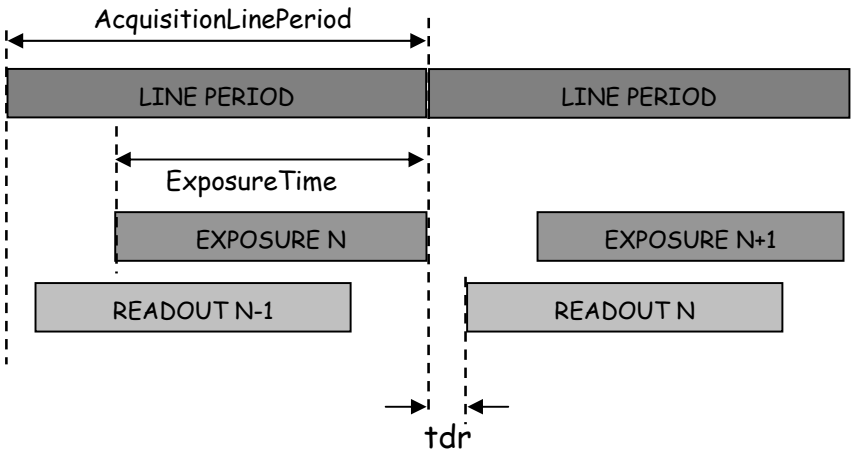
- **Continuous**

This mode doesn't require an external trigger.
In this case, the line period can be defined in the Camera (see below) but the real line period of the camera depends also on the exposure time set:

- If ExposureTime > AcquisitionLinePeriod, the line period is equal to ExposureTime

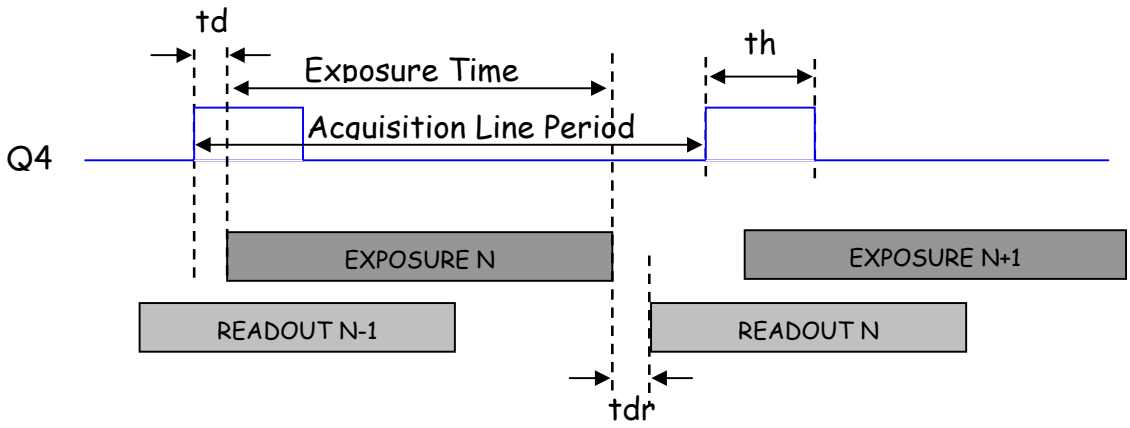


- If AcquisitionLinePeriod > ExposureTime, the line period is equal to Acquisition Line Period



- **Ext Trig with integration time set in the camera**

This mode requires an external trigger (via Q4) but the exposure time is the one defined in the Camera.

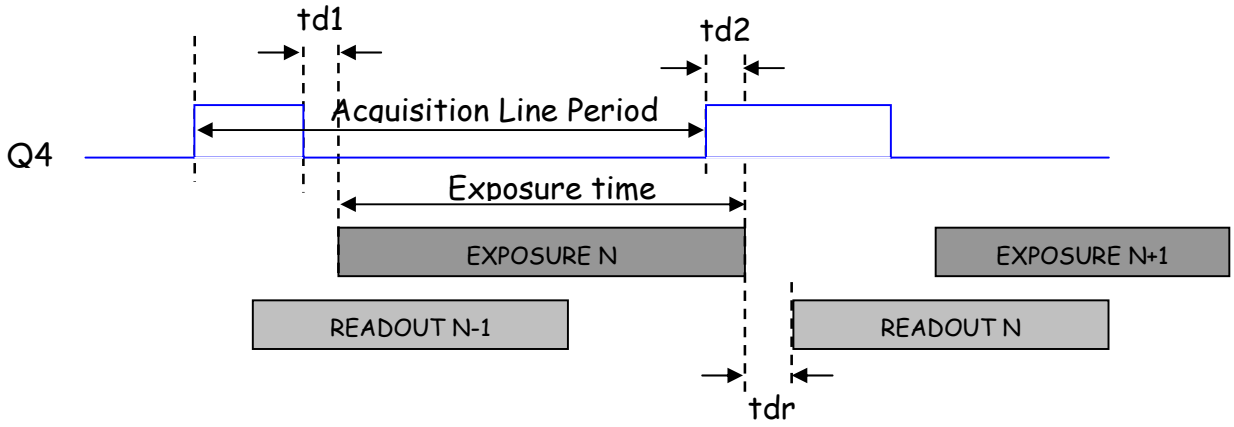


- *If the line period of the Trig signal provided to the camera is smaller than the exposure time set in the camera, the "short trig pulses" will be ignored: The exposure set in the camera defines the minimum line period possible.*
- *Q4 is based on an external trigger, if trigger used is not completely the same as Q4 described above, the PLC allows to modify it in order to match input signal and Q4 signal needed.*

- **Ext Trig with Exposure Time Controlled (ETC) with one Trig**

This mode requires an external trigger (via Q4). Both exposure time and line period are defined by this Trig signal:

- The exposure time during the low level of the Trig Signal
- The line period between two rising edges of the Trig Signal



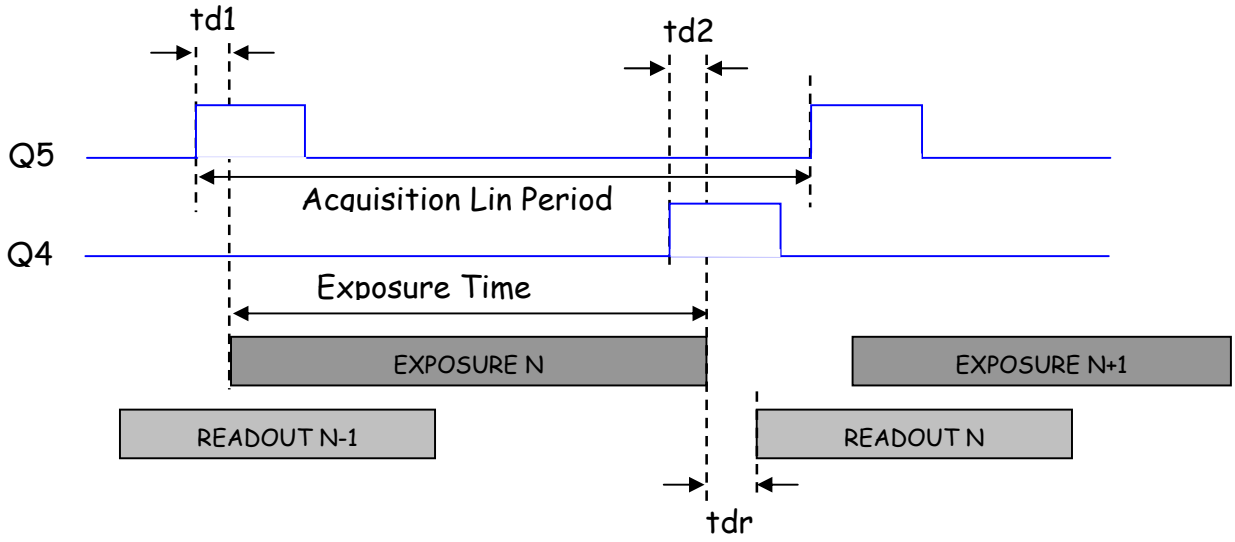
- *Q4 is based on an external trigger, if trigger used is not completely the same as Q4 described above, the PLC allows to modify it in order to match input signal and Q4 signal needed.*

- **PLC controlled**

This mode requires two external triggers (via Q4 and Q5):

- Q5 controls the starting of the exposure time
- Q4 controls the end of the exposure time.

The line period is defined by the one of the Q5 Trig signal.



Programmable Logic Controller (PLC) management

Signals available at Q4 and Q5 of the PLC have to be as signals described above. To transform trigger like this, a PLC is available between trigger input and Q4 and Q5.

- At First power on, PLC is like a "wire" were input and Q4 are directly linked without any signal treatment inside PLC.
- Diviina camera has only 2 inputs: one for line trigger and the other for frame trigger; if the PlcControlled mode is used, a new signal has to be created from the line trigger input with PLC help.

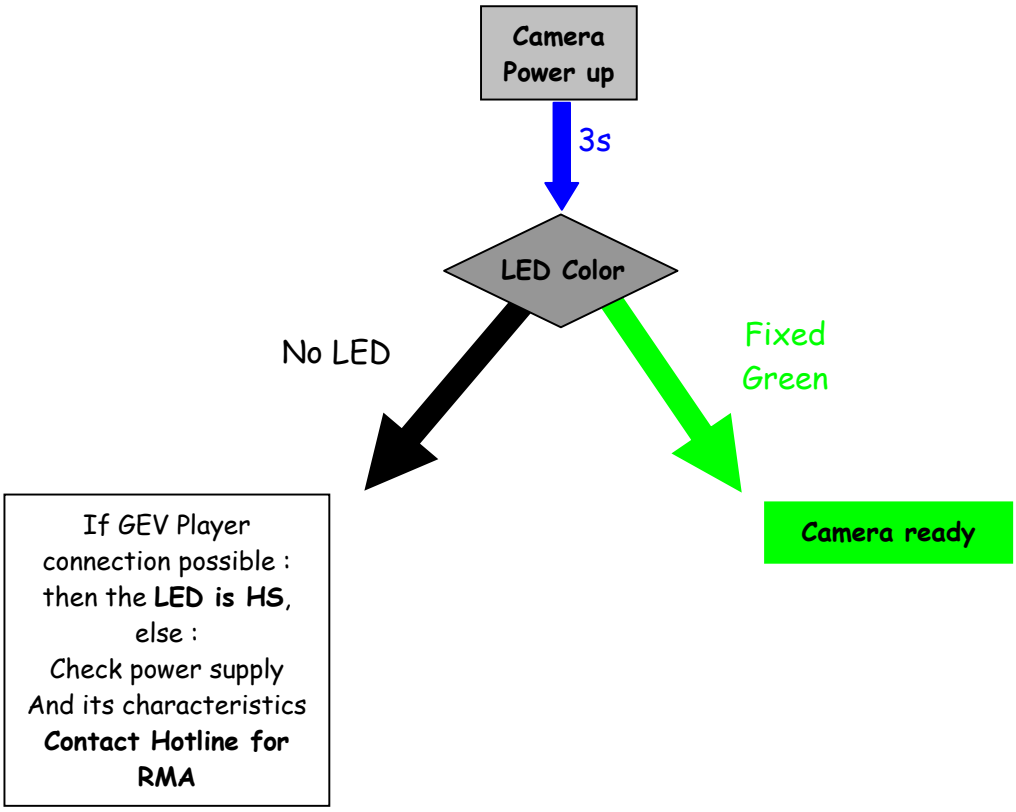
For more information please refer to the Pleora documentation: "*Programmable Logic Controller, Reference Guide*".

12 APPENDIX D : Camera Features

Feature name	access	Value	Interface
AcquisitionFrameCount	R/W	From 1 to 255	IInteger
AcquisitionLinePeriod	R/W	From minimum sensor value to 65535	IInteger
AcquisitionMode	R/W	Continuous SingleFrame MultiFrame ContinuousRecording ContinuousReadout SingleFrameRecording SingleFrameReadout	IEnumeration
AcquisitionStart	W	-	ICommand
AcquisitionStop	W	-	ICommand
AdaptativeTapBalance	R/W	Enable Disable	IBoolean
BinningHorizontal	RO	1	IInteger
BlackLevel	R/W	From 0 to 255	IInteger
BlackLevelSelector	R/W	All Tap1 Tap2	IEnumeration
DecimationHorizontal	RO	1	IInteger
DecimationVertical	RO	1	IInteger
DeviceFirmwareVersionMajor	RO	1	IString
DeviceFirmwareVersionMinor	RO	0	IString
DeviceFirmwareVersionSubMinor	RO	0	IString
DeviceID	RO		IString
DeviceManufacturerInfo	RO		IString
DeviceModelName	RO	DiviinaLM1	IString
DeviceScanType	R/W	Linescan Areascan	IString
DeviceUserID	W	-	IString
DeviceVendorName	RO	e2v	IString
ExposureTime	R/W	From 4 to 65535	IInteger
Gain	R/W	From 0 to 880	IInterger
Gainselector	R/W	All Tap1 Tap2	IEnumeration
Height	R/W	From 1 to 16384	IInteger
LineTriggerMode	R/W	Continuous ExtTrigWithExpTimeSet ExtETCwithOneTrig PlcControlled	IEnumeration
OffsetX	R/W	From 1 to maximum sensor size	IInteger
PixelCoding	RO	Mono	IEnumeration
PixelColorFilter	RO	None	IEnumeration
PixelFormat	RO	Mono8	IEnumeration

PixelSize	RO	Bpp8	IEnumeration
SensorDigitalisationTaps	RO	Two	IEnumeration
SensorHeight	RO	1	IInteger
SensorWidth	RO	Maximum size of the sensor	IInteger
TestImageSelector	R/W	Off IPEngineTestPattern	IEnumeration
UserSetLoad	W	-	ICommand
UserSetSave	W	-	ICommand
UserSetSelector	R/W	Default UserSet1	IEnumeration
Width	R/W	From 1 to maximum pixel size	IInteger

13 APPENDIX E : TROUBLESHOOTING



14 APPENDIX F: Revision History

Doc. Revision	Comments / Details	Camera Ref
Preliminary	Preliminary release	Firmware 1.0.0
A	First Release	Firmware 1.1.0
B	Mount Drawing Correction	Firmware 5.0.0
C	"Out of the Box" chapter	Firmware 5.0.0

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